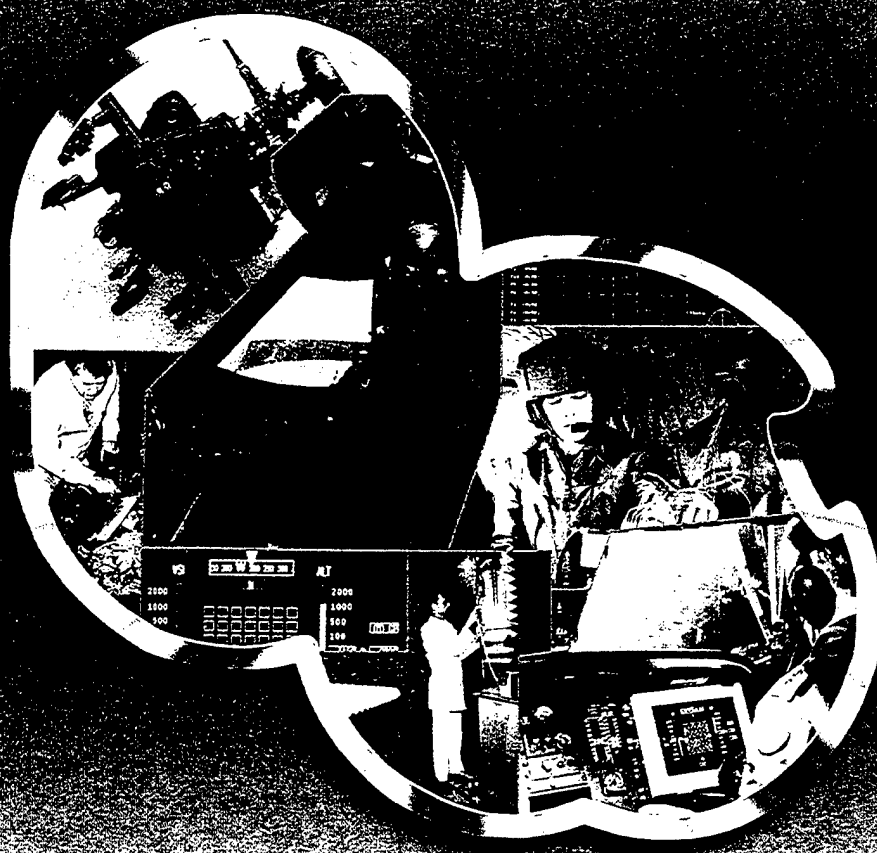


USAARL Report No. 2005-03

User Survey of Peripheral Vision-Restricting Devices

by Arthur Estrada



Aircrew Health and Performance Division

February 2005

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Introduction

For decades, civilian and military flight trainers have used peripheral vision-restricting devices (PVRDs) in order to enhance instrument flight training that was performed during periods of visual meteorological conditions (outside of clouds). During periods of instrument meteorological conditions, or IMC (basically, in clouds), PVRDs are not required because all visual references are naturally restricted to the aircraft cockpit. However, during visual conditions, pilots can easily refer to outside visual references for spatial orientation and navigational cues. Therefore, it has been the accepted practice to artificially restrict the pilot's view by using PVRDs. These devices allow the viewing of the aircraft flight instruments while effectively restricting the viewing of outside visual references. Theoretically, the use of PVRDs prepares pilots to fly in clouds or other conditions of limited visibility with reference to instruments only. However, in addition to limiting a pilot's view only to the primary flight instruments, PVRDs may cause the artificial exclusion of the full cockpit environment, i.e., overhead switches and gauges, and those on the center and opposite-pilot side of the instrument panel.

Background and military significance

The use of PVRDs for the majority of U.S. Army aviators is not voluntary during instrument training. These devices are required per the conditions listed in U. S. Army Aircrew Training Manuals for most aircraft. The "conditions" under which each instrument maneuver must be trained and/or performed, under visual conditions (outside of the clouds), require a PVRD. Therefore, PVRDs must be worn in accordance with current directives regardless of any potential negative effects on training and proficiency.

There seems to be a general reluctance by Army aviators to wear PVRDs. Anecdotal information suggests that the restrictions and loss of peripheral information and spatial orientation due to PVRD use may cause adverse physiological and psychological effects. Casual conversations among some instructor pilots describe experiences during which their students complain of adverse effects during instrument training while wearing PVRDs, including loss of situational awareness and spatial disorientation.

Review of relevant literature and research

An extensive search for relevant literature and research (including works in progress) produced no indications of any previous studies regarding the effects of PVRDs. The searches did, however, produce many advertisements for such devices for sale. A detailed description of the literature review process is available in Appendix B.

A search of the Federal Aviation Administration's accident database produced no evidence of aviation accidents related to the use of PVRDs. Regarding reports on instrument flight accidents, the use of PVRDs is recommended to increase pilot instrument flight proficiency as a way to mitigate such accidents. In a study relating to *limited in-cockpit vision* (indirectly related)

published by Wildzunas (1995) on the visual performance effects of an aviation chemical protective mask, he reports of degraded pilot performance while wearing the mask. He writes:

...while [aviators] may not want to fly in a protective mask, when asked to do so, they can overcome the inherent task difficulties and perform their assigned duties. It is possible that these difficulties stemmed from decreases in the field-of-view (FOV) inherent with wearing protective masks. ... The deflated performance scores for the [flight] maneuvers in the simulator also may be indicative of FOV problems.

Objectives

Based on the apparent lack of information and research in this area, a survey (Appendix A) was administered to Army helicopter aviators (student pilots, instructor pilots and those attending helicopter instructor pilot courses at Ft. Rucker, Alabama). The purposes of the survey were:

1. to achieve an understanding of the extent of peripheral vision-restricting device use and any adverse effects (real and/or perceived) on aviator training and proficiency; and
2. to determine if further research into the effects and use of PVRDs is warranted.

Methods

Subjects

One-hundred and twenty-one operational Army helicopter aviators were anonymously surveyed at Ft. Rucker, Alabama. These personnel consisted of student pilots, instructor pilots and those attending helicopter instructor pilot courses. Many of these aviators were members of units stationed around the world on temporary duty at Fort Rucker and represented pilots qualified in all U.S. Army helicopter types. There were no restrictions on age, rank, gender, etc. Specific demographics were not sought.

This study was exempt from the requirement to gain informed consent from the participants due to its anonymous nature in accordance with 45 CFR 46.101(b)(2) (U.S. Department of Health and Human Resources, n.d.).

Materials

A survey questionnaire (Appendix A) solicited user opinions concerning PVRDS, their use and any adverse effects attributed to the PVRDs.

Procedures

Local volunteers were asked to fill out the questionnaire during regularly scheduled safety

meetings and other gatherings of pilots at Ft. Rucker airfields.

Results and Discussion

The results (descriptive statistics) of the survey are presented below (Tables 1-7). Note that some respondents selected more than one answer to Questions #2 and #6. The percentages depicted in Tables 2 and 6 represent the percentage of the survey population of 121 respondents within an answer group; and therefore, the sum of the percentages are greater than 100% for these two questions.

Answers to survey questions

Table 1.

How often do you use a peripheral vision-restricting device to train for instrument flight?

| Never | Weekly | Biweekly | Monthly | Quarterly | Semiannually | Annually | Daily | Misc |
|-------|--------|----------|---------|-----------|--------------|----------|-------|------|
| 6 | 29 | 5 | 10 | 6 | 6 | 8 | 45 | 6 |
| 5% | 24% | 4% | 8% | 5% | 5% | 7% | 37% | 5% |

The findings indicate that PVRDs were used by 95% of those surveyed. These data indicate that over a third of the survey population use a PVRD daily while almost a quarter use them weekly. This high percentage of frequent use reported by some respondents is due to the survey being conducted at Fort Rucker, Alabama (the Army's flight school), where instrument flight training occurs daily. Based on the investigator's first hand knowledge and 24 years of experience as an Army aviator, this frequency of use is atypical in operational aviation units in the field. Aviators in operational units are more likely to use PVRDs on a quarterly or semiannual frequency. An advantage of this atypical representation of experienced PVRD users is that the respondents are presumably more attuned to any adverse effects of PVRD use and are able to address subsequent survey questions from an informed perspective.

Table 2.

What device do you normally use, if and when you use one? (Seven respondents supplied two answers.)

| Hood w/NVG mount | Hood w/o mount | DA 2408-12/-13 (paper form) | Visor sticker | Foggles® | Jeppeson® Flip-up | Did not answer |
|------------------|----------------|-----------------------------|---------------|----------|-------------------|----------------|
| 19 | 7 | 6 | 74 | 5 | 1 | 15 |
| 16% | 6% | 5% | 61% | 4% | 1% | 12% |

There is no standard device used by Army aviators or required by Army directives. Six devices were reported as being used by the respondents: hood, hood with NVG (night vision goggle) mount, visor sticker, Foggles[®], a paper form and Jeppesen[®] Flip-up glasses. Visits to pilot-supply stores and an internet search for PVRDs indicate that five of the six devices (minus the paper form) identified in the survey were representative of those commercially available (manufacturer variations were minor). Basically, there are three general types: a plastic adhesive sheet (visor sticker), which is attached onto a helmet visor; hoods, which extend outward from the forehead or helmet; and partially frosted glasses (such as Foggles[®] and Jeppesen[®] Flip-up), which are worn on the face.

Visor sticker

The visor sticker (Figure 1) used during the study was the device used by 61% of the surveyed population. The sticker was purchased locally for \$2.99 and its low cost may explain some of its popularity.

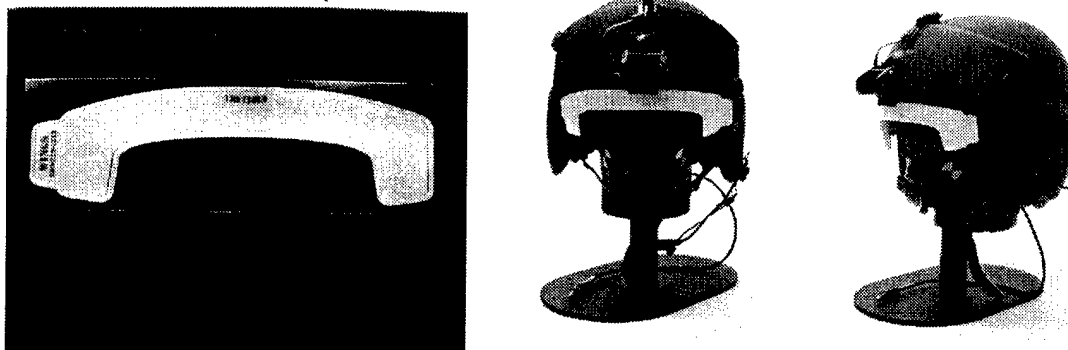


Figure 1. Visor sticker.

Hood with NVG mount

The hood with NVG mount (Figure 2), the second most popular with 16%, is a field modification of a standard Gentex[®] hood (see *Hood* below). An old NVG mount is bolted on the hood so that it can be flipped up and out of the way when not in use.

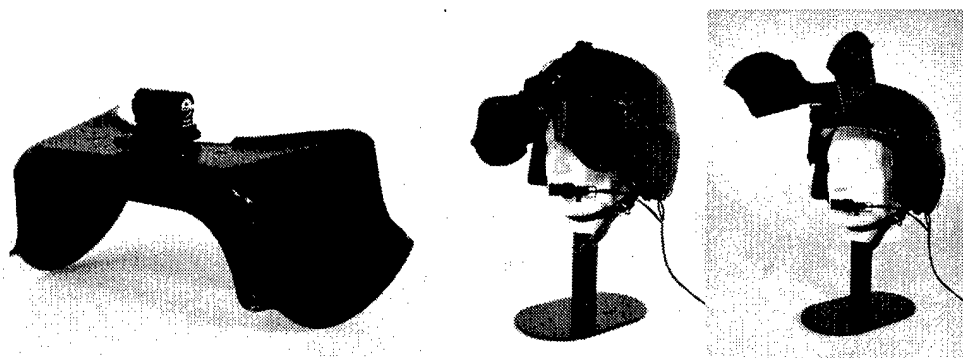


Figure 2. Hood w/NVG mount.

Hood

The hood (Figure 3), used by 6% of the respondent population, is available through the government supply system (National Stock Number 8415-01-394-8453). Its cost per unit is \$52.40 and it is made of thin, semi-flexible plastic. It is made by the Gentex Corporation and snaps onto the HGU-56/P helmet. (The HGU-56/P is the helmet worn by all Army aviators except AH-64 Apache pilots.)

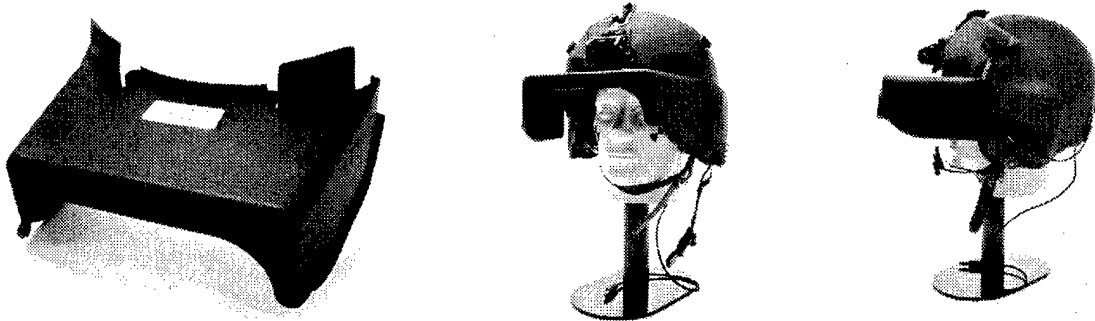


Figure 3. Hood.

DA Form 2408-12 or -13 (paper form)

Five percent reportedly use a DA Form 2408-12 or -13. This government form is contained in the aircraft's logbook. This field-expedient solution is a 7 x 8½-inch paper card. Based on the principal investigator's experience, its use provides too much variability in fields of view because the fields of view are dependent on how far the card is pushed up into the visor protector. Additionally, its security on the helmet is not dependable, as it tends to fall easily during use.

Foggles®

The Foggles® (Figure 4), used by 4%, are available commercially for about \$24.95. Although available in different colors, the photographs below depict a set with clear lenses with white shading.

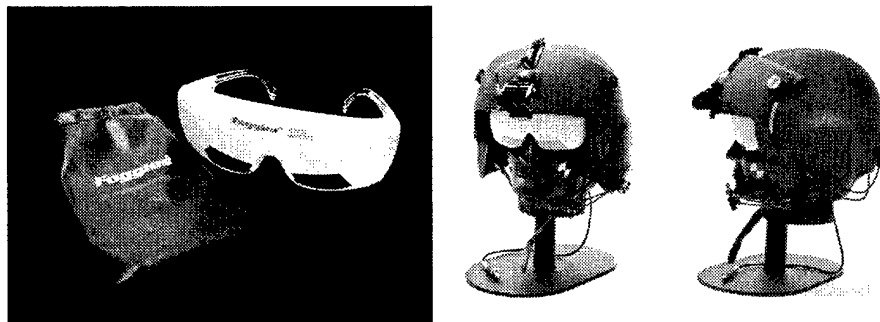


Figure 4. Foggles®.

Jeppesen® Flip-up glasses

One respondent reported the use of Jeppesen® Flip-up glasses. They are very similar to the Foggles® described above, but are secured to the head by a headband and are available for about \$27.95. (Picture is unavailable.)

Table 3.

Is there a device that you would prefer to use, if and when you use one?

| Hood w/NVG mount | Hood w/o mount | Visor sticker | Foggle | No Preference | Did not answer |
|------------------|----------------|---------------|--------|---------------|----------------|
| 8 | 2 | 22 | 5 | 41 | 43 |
| 7% | 1% | 18% | 4% | 34% | 36% |

Of those who had a device preference, most preferred the visor sticker. Interestingly, 34% had no preference and unexplainably, 36% did not provide an answer.

Table 4.

Do you feel that a peripheral vision-restricting device is important to instrument training and proficiency?

| Yes | No |
|-----|-----|
| 95 | 26 |
| 79% | 21% |

Nearly 4/5 of the respondents believed that a PVRD is important to instrument training and proficiency.

Table 5.

Do you feel that a peripheral vision-restricting device should be standardized for Army issuance and use?

| Yes | No | Did not answer |
|-----|-----|----------------|
| 81 | 35 | 5 |
| 67% | 29% | 4% |

Table 6.

Have you ever experienced any of the following negative effects while wearing a peripheral vision-restricting device? (Twenty-nine respondents supplied more than one answer.)

| Uneasiness | Despair | Distraction | Nausea | Claustrophobia | Loss of Situational Awareness | Spatial Disorientation | Miscellaneous Negative Effects | No Negative Effects | Did not answer |
|------------|---------|-------------|--------|----------------|-------------------------------|------------------------|--------------------------------|---------------------|----------------|
| 18 | 6 | 10 | 7 | 9 | 16 | 35 | 9 | 48 | 11 |
| 15% | 5% | 8% | 6% | 7% | 13% | 29% | 7% | 40% | 9% |

The most revealing data collected by this survey were those regarding negative effects. Although 40% of the respondents reported no negative effects as a result of PVRD use, the majority (51%) reported the following effects: 18 reported uneasiness; 6 reported despair; 10, distraction; 7, nausea; 9, claustrophobia; 16, loss of situational awareness; 35, spatial disorientation; and 9 reported miscellaneous negative effects.

Table 7.

How often have you experienced the above negative effects?

| Not applicable | Each time | Occasionally | Frequently | Rarely | Did not answer |
|----------------|-----------|--------------|------------|--------|----------------|
| 55 | 5 | 21 | 3 | 35 | 2 |
| 45% | 4% | 18% | 2% | 29% | 2% |

Although 29 percent experienced these negative effects rarely, 18% experienced them occasionally, with 5 (4%) individuals experiencing them during each use.

Conclusions

The results of this user survey provided basic information regarding PVRD use not available in the literature. These data identified which devices are being commonly used and which are preferred, and provided an idea of their acceptability and apparent importance based on the opinions of a sample of the user community. Most importantly, these results indicate that there seem to be adverse effects associated with the use of PVRDs. These adverse effects may actually interfere with the effective instrument training of Army aviators.

Recommendations

Although various PVRDs are available and used, there appear to be considerations of cost and preference that should be explored. Undoubtedly, PVRD use will continue to be a

requirement for instrument flight training in visual environments. Therefore, it is recommended that future research be conducted during actual or simulated flight that evaluates different types of PVRDs as to their effectiveness as a training aid and their performance in minimizing the adverse effects identified in this survey.

References

- U.S. Department of Health and Human Resources. (n.d.). *Code of Federal Regulations. Title 45. Public Welfare. Part 46. Protection of Human Subjects*. Retrieved January 28, 2005, from <http://www.hhs.gov/ohrp/humansubjects/guidance/45cfr46.htm#46.101>.
- Wildzunas, R. M. December 1995. Visual Performance Effects and User Acceptance of the M43A1 Aviation Protective Mask Frontserts. Aviation, Space, and Environmental Medicine, 66(12), 1136-1143.

Appendix A.

User survey.

**United States Army Aeromedical Research Laboratory
Fort Rucker, Alabama**

This survey is anonymous. The information collected will help determine if the hoods, Foggles[®], and other peripheral vision-restricting devices currently available and in use are satisfactory or if there is a need to develop a standard device for use by the U.S. Army.

Please circle the responses that most accurately answer the following questions.

1. How often do you use a peripheral vision-restricting device to train for instrument flight?

Never weekly biweekly monthly quarterly semiannually
annually Other (be specific) _____

2. What device do you normally use, if and when you use one? (List manufacturer or National Stock Number, if possible.)

3. Is there a device that you would prefer to use, if and when you use one? (List manufacturer or National Stock Number, if possible.)

4. Do you feel that a peripheral vision-restricting device is important to instrument training and proficiency?

Y N Explain, if necessary _____

5. Do you feel that a peripheral vision-restricting device should be standardized for Army issuance and use?

Y N Explain, if necessary _____

6. Have you ever experienced any of the following negative effects while wearing a peripheral vision-restricting device? (Circle all that apply.)

Uneasiness Despair Distraction Nausea Claustrophobia

Loss of Situational Awareness Spatial Disorientation No Negative Effects

Other _____

7. How often have you experienced the above negative effects?

N/A Each Time Occasionally Frequently Rarely

*****PLEASE PROVIDE ANY ADDITIONAL COMMENTS ON BACK OF THIS FORM*****

Appendix B.

Details of relevant literature and research review process.

An extensive search for relevant literature and research (including works in progress) included the exploration of DTIC (Defense Technical Information Center), NTIS (National Technical Information Service), MEDLINE (a service of the U.S. National Library of Medicine and the National Institutes of Health), and psychINFO (American Psychological Association) databases. The following keywords and constructs were used: instrument flight <and> accident or mishap (any variations); instrument flight <and> training; instrument flight <and> vision <and> (restriction <or> interference <or> restrictor <or> restrictors); aviation accidents <and> instrument flight; cockpit (any variations) <and> vision; cockpit (any variations) <and> inside; cockpit (any variations) <and> within; cockpit (any variations) <and> inside <and> within; instrument hood (any variations); and instrument hood (any variations) and vision. The searches produced no PVRD-related research or literature.

An additional search of the worldwide web using search engines Yahoo!, Google, and Dogpile; and the Federal Aviation Administration's accident summary files produced significant numbers of reports and articles regarding instrument flight and accidents; however, none had anything to do with the proposed research subject, PVRD usage, even indirectly. These searches, however, produced many advertisements for such devices for sale. The following keywords and constructs were used: instrument flight accidents; instrument flight training; instrument flight vision restrictors; cockpit vision restrictors; and instrument hoods.

Manufacturer's list

The Foggles® (USPN 4698022)
Foggles® Incorporated
(800) 521-3001
www.foggles.com

The Hood (Vision Restricting Visor, 81990/1680-ALSE-110-1)
Gentex® Corporation
324 Main Street
Simpson, PA 18407
(570) 282-3550
www.gentexcorp.com

"The Cloud" (visor sticker)
Wings Aviation Products
990 N. Daleville Avenue
Daleville, AL 36322
(334) 598-6212
(800) 223-1213
www.wings-aviation.com

Jeppesen®
55 Inverness Drive East
Englewood, CO 80112-5498
(303) 799.9090
www.jeppesen.com